Claims numbered claim 1 (canceled) through claim 63 (canceled) are canceled (canceled).

64.(currently amended) A method for valuing [any type of financial security] financial securities, respective endogenous variables of a financial security, said variables comprising Cash receipts (C), Yield (Y) and Time (T), comprising steps of:

utilizing a universal pricing function, said pricing function comprising:

$P = f\{ C, Y, T \}$ where C, Y, and T are variables endogenous to the security
P = Market Price; de facto, empirical or expected market price
C = Cash Receipts; coupon, dividend, premium payments, principal/par
Y = Yield; a single term relating security's return, relative to P, C, T
T = Time; a fixed, expected or continuous measure of said security's life;

determining values of said endogenous variables, respective said security's price, [wherein further comprising step of] by:

determining a singular yield value for said security or for a basket of securities, utilizing Formula, Yield M, or Yield Md, said Formulae comprising:

$$\text{Yield M} = \frac{\sum(\text{Maturity} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}),\ \text{for all issues}}{\sum(\text{Maturity} \times \text{Portfolio Coefficient}),\ \text{for all issues}}$$

$$\text{Yield Md} = \frac{\sum(\text{Duration} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}),\ \text{for all issues}}{\sum(\text{Duration} \times \text{Portfolio Coefficient}),\ \text{for all issues}}$$

where Issue = Security; All Issues = Securities comprising a basket of securities
Yield M or Yield Md = Governing Yield = Y
Maturity = Time = Maturity in Years, Expected Life, Term of Policy
Portfolio Coefficient = Present Value, per issue/Present Value, $\sum$ issues
Present Value = Cost to Presently Purchase
YTM = Yield-To-Maturity, a means providing yield respective time,

where for Single Issue: Portfolio Coefficient is one, Yield M = YTM
for Portfolio: said formula creating a single Yield M value of all issues;

solving said security's price using said values of said endogenous variables, or solving third endogenous variable utilizing said security's price and two of three endogenous variables.

65.(original) The method of claim 64, which further comprises the step of coding said Formulae of Yield M or Yield Md, as:

Yield M =YM = (sum{(Maturity*Portfolio Coefficient*YTM)$_1$, (M*PC*YTM)$_2$,...})/
(sum{(Maturity*Portfolio Coefficient)$_1$, (M*PC)$_2$,...});

Yield Md =YMD = (sum{(Duration*PC*YTM)$_1$, (D*PC*YTM)$_2$,...})/
(sum{(Duration*Portfolio Coefficient)$_1$, (D*PC)$_2$,...}).

66.(currently amended) A method for determining the mathematical valuation and sensitivity functions of a financial security, wherein determining said security's Yield-to-Maturity (YTM), Duration (K) and Convexity (V) values utilizing a precise non-summation form discounting cash receipts, said non-summation form being a continuous differentiable function not comprising summing discounted cash receipts, utilizing said security's endogenous variables of Cash receipts (C), Yield (Y) and Time (T):

determining relation of price to Yield-to-Maturity, utilizing [the] <u>a</u> Formula of:

Price to Yield-to-Maturity, a non-summation form discounting cash receipts:

$$\text{Price} = \frac{C}{Y}\left(1 - (1 + Y/2)^{-2T}\right) + (1 + Y/2)^{-2T}$$

where C = Coupon Y = YTM T = Maturity (in years),

determining relation of Change in Price for Change in Yield, Duration, a precise first derivative deriving by exact differentiation [by mathematical calculus] of said non-summation form discounting cash receipts, utilizing [the] Formula of:

Duration, modified annualized, wherein semi-annual C payments:

$$K = \frac{-C}{Y^2}\left(1 - (1 + Y/2)^{-2T}\right) + \frac{C}{Y}(T + TY/2)^{-2T-1} - (T + TY/2)^{-2T-1}$$

where C=Coupon Y=YTM T=Maturity in Years δY=ΔYield M δP=ΔPrice

Duration, modified annualized, wherein n annual C payments:

$$K \text{ generalized} = \frac{-C}{Y^2}\left(1 - (1+Y/n)^{-nT}\right) + \frac{C}{Y}(T + TY/n)^{-nT-1} - (T+TY/n)^{-nT-1}$$

wherein n = # cash receipts per annum, wherein determining semi-annual form as:

$$K = \frac{-C}{Y^2} + \frac{C}{Y^2}(1+Y/2)^{-2T} - (1 - C/Y)(T + TY/2)^{-2T-1} \quad ;$$

determining relation of Change in the Change in Yield, Convexity, a precise second derivative deriving by exact differentiation [by mathematical calculus] of said non-summation form discounting cash receipts, utilizing [the] Formula of:

$$\text{Convexity } V = \frac{2C}{Y^3} - \frac{\frac{2C}{Y^3}}{(1+Y/2)^{2T}} - \frac{\frac{CT}{Y^2}}{(1+Y/2)^{2T+1}} - \frac{\frac{C}{Y^2}}{(T+TY/2)^{2T+1}} + \frac{(1+C/Y)(T^2+T/2)}{(T+TY/2)^{2T+2}}$$

wherein calculating V where Y = YTM, Yield M, or, Yield M – YTM basis.

67. (original) The method of claim 66, which further comprises the step of coding said Formula of YTM, as algorithm:

semi-annual P = PR = ((C/Y)*(1–(1+(Y/2))^(-2*T))+(1+(Y/2))^(-2*T)
where C, Y and P are decimal values, T=Maturity in years,

generalized P = PRBOND= ((C/Y)*(1–(1+(Y/N))^(-N*T))+(1+(Y/N))^(-N*T)
where N=n= cash receipts per annum, wherein semi-annual=2.

68.(original) The method of claim 66, which further comprises the step of coding said Formula of Duration (K), as algorithm:

```
K semi-annual = DPDY = ((-C/(Y^2))*(1–((1+(.5*Y))^(-2*T))))
                       +((C/Y)*((T+(.5*Y*T))^((-2*T) –1)))
                       –((T+(.5*Y*T))^((-2*T) –1))
```
where C and Y are decimal values, T=Maturity in years

```
K generalized =BONK= ((-C/(Y^2))*(1–((1+(Y/N))^(-N*T))))
                     +(((C/Y) –1)*T*((1+(Y/N))^((-N*T)–1)))
```

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

generalized, alternate formulation
K generalized =BINK= (-C/(Y^2))+((C/(Y^2))*((1+(Y/N))^(-N*T)))
alternate form −((1−(C/Y))*((T+((T*Y)/N))^((-N*T) −1))).

69.(original) The method of claim 66, which further comprises the step of coding said Formula of Convexity (V), as algorithm:

generalized
V =BONV= (((2*C)/(Y^3))*(1−(1+(Y/N))^(-N*T)))
−((C/Y^2)*(2*T)*((1+(Y/N))^((-N*T) −1)))
−(((C/Y) −1)*(((N*T)+1)*(T/N))*((1+(Y/N))^((-N*T) −2)))

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

spread-based, semi-annual
V =VEXA= (((2*C)/(Y^3)) −(((2*C)/(Y^3))*((1+(Y/2))^(-2*T)))
−((C*T)/(Y^2))*((1+(Y/2))^((-2*T) −1))
−((C/(Y^2))*((T+(T*(Y/2)))^((-2*T) −1)))
+((1+(C/Y))*((T^2)+(T/2))*((T+(T*(Y/2)))^((-2*T) −2))))/10000

where Y=spread=YieldM−YTM, expressed in decimal, wherein if Y=0.14%=0.14
where Y=Yield M, expressed in decimal, wherein if Y= Yield M= 6.06%= 0.0606

spread-based, generalized
V =VEX= (((2*C)/(Y^3)) −(((2*C)/(Y^3))*((1+(Y/N))^(-N*T)))
−((C*T)/(Y^2))*((1+(Y/N))^((-N*T) −1))
−((C/(Y^2))*((T+(T*(Y/N)))^((-N*T) −1)))
+((1+(C/Y))*((T^2)+(T/N))*((T+(T*(Y/N)))^((-N*T) −2))))/10000

where Y = Yield M, expressed in decimal, wherein if Y = Yield M = 6.06% = 0.0606.

70. (currently amended) A process for computing financial data using endogenous variables of a financial security, wherein said financial security comprising a bond, equity or insurance policy, comprising:

identifying data values for the security's endogenous variables, of C, Y, and T, wherein said variable C comprises cash receipts, and wherein said variable Y comprises yield, and wherein said variable T comprises time-to-maturity, expected life, or a fixed term;

determining governing yield, for a single security issue, wherein applying processing function Yield M (or Md), determining yield-to-maturity per summation form or per non-summation form, wherein:

function of yield-to-maturity, a summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{2} \sum_{T=1}^{2T} (1 + Y/2)^{-T} + (1 + Y/2)^{-2T}$$

where C = Coupon Y = YTM T = Maturity (in years),

wherein as coded computational processing algorithm:

Price= P = (C/2)*(sum{(((1+(Y/2))^(-T))+((1+(Y/2)^(-2*T)))$_1$,
(((1 + (Y/2)^(-T))+((1+(Y/2)^(-2*T)))$_2$,...})
where semi-annual coupon payments (2 per annum);

Price= P = (C/N)*(sum{(((1+(Y/N))^(-T))+((1+(Y/N)^(-N*T)))$_1$,
(((1 + (Y/N)^(-T))+((1+(Y/N)^(-N*T)))$_2$,...})
where N-annual coupon payments (N per annum);

function of yield-to-maturity, a non-summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{Y} (1 - (1 + Y/2)^{-2T}) + (1 + Y/2)^{-2T}$$

where C = Coupon Y = YTM T = Maturity (in years),

wherein as coded computational processing algorithm:

semi-annual P = PR = ((C/Y)*(1–(1+(Y/2))^(-2*T))+(1+(Y/2))^(-2*T)
where C, Y and P are decimal values, T=Maturity in years,

generalized P = PRBOND= ((C/Y)*(1–(1+(Y/N))^(-N*T))+(1+(Y/N))^(-N*T)
where N=n= cash receipts per annum, semi-annual=2;

function of governing yield, a singular universal form for securities:

$$\text{Yield M} = \frac{\sum (\text{Maturity} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{ for all issues}}{\sum (\text{Maturity} \times \text{Portfolio Coefficient}), \text{ for all issues}}$$

wherein Yield M as coded computational processing algorithm:

Yield M =YM = (sum{(Maturity*Portfolio Coefficient*YTM)$_1$, (M*PC*YTM)$_2$,...})/
(sum{(Maturity*Portfolio Coefficient)$_1$, (M*PC)$_2$,...});

$$\text{Yield Md} = \frac{\sum(\text{Duration} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{ for all issues}}{\sum(\text{Duration} \times \text{Portfolio Coefficient}), \text{ for all issues}}$$

wherein Yield Md as coded computational processing algorithm:

Yield Md =YMD = (sum{(Duration*PC*YTM)$_1$, (D*PC*YTM)$_2$,...})/
(sum{(Duration*Portfolio Coefficient)$_1$, (D*PC)$_2$,...})

where Issue = Security; All Issues = Securities comprising a basket of securities
Yield M = Governing Yield = Y
Maturity = Time = Maturity in Years, Expected Life, Term of Policy
Portfolio Coefficient = Present Value, per issue/Present Value, $\sum$ issues
Present Value = Cost to Presently Purchase
YTM = Yield-To-Maturity, a means providing yield respective time, determining YTM by summation or non-summation form,
for Single Issue: Portfolio Coefficient is one, Yield M = YTM
for Portfolio: the Yield M functions create a single Yield M value of all issues;

determining arbitrage spreads between Yield M and spot, and Yield M and YTM, wherein said arbitrage spread comprising a differential between Yield M and spot, or YTM;

determining measures of the security's pricing sensitivities, duration and convexity, as Taylor series first and second order terms, or as first and second derivatives, respectively, wherein:

function of change in price for change in yield, duration, a first order term of a Taylor series approximation to deriving the first derivative of summed discounted cash receipts, wherein said Taylor series being a standard numerical method providing a derivative approximation:

Duration, modified annualized:

$$\text{(Duration) Durmodan} = \frac{\frac{C}{Y^2}\left[1 - \frac{1}{(1+Y)^{2T}}\right] + \frac{2T(100 - C/Y)}{(1+Y)^{2T+1}}}{2P}$$

where D = ΔP/ΔYTM
Y = YTM
T = Mat. in Years
C = Coupon
P=Price (par=100),

wherein as coded computational processing algorithms:

semi-annual Durmodan=DURMOD=((((C/2)/((Y/2)^2))*(1-(1/((1+(Y/2))^(2*T)))))
+((2*T)*(100-((C/2)/(Y/2))))/((1+(Y/2))^((2*T)+1))))/(2*P)
where P = Price (of 100)

generalized Durmodan=DURMD= ((((C/N)/((Y/N)^2))*(1–(1/((1+(Y/N))^(N*T))))
+(((N*T)*(100–((C/N)/(Y/N))))/((1+(Y/N))^((N*T)+1)))))/(2*P)

where N=n= # C periods per annum; semi-annual=2; T=Maturity in years;

function of change in the change in yield, convexity, a second order term of a Taylor series approximation to deriving the first derivative of summed discounted cash receipts, wherein said Taylor series being a standard numerical method providing a derivative approximation:

$$\text{(Convexity) Convex} = \frac{\frac{2C}{Y^3}\left[1 - \frac{1}{(1+Y)^{2T}}\right] + \frac{2C(2T)}{Y^2(1+Y)^{2T+2}} + \frac{2T(2T+1)(100 - C/Y)}{(1+Y)^{2T+2}}}{4P}$$

wherein as coded computational processing algorithms:

semi-annual Convex = CON = (((C/((Y/2)^3))*(1–(1/((1+(Y/2))^(2*T)))))
–((C*(2*T))/(((Y/2)^2)*((1+(Y/2))^((2*T)+1))))
+(((2*T)*((2*T)+1)*(100-(C/Y)))/((1+(Y/2))^((2*T)+2))))/(4*P)

generalized Convex = CONDP = (((C/((Y/N)^3))*(1–(1/((1+(Y/N))^(N*T)))))
–((C*(N*T))/(((Y/N)^2)*((1+(Y/N))^((N*T)+1))))
+(((N*T)*((N*T)+1)*(100-(C/Y)))/((1+(Y/N))^((N*T)+2))))/(4*P)

where N=n= # C periods per annum; semi-annual=2; T=Maturity in years;

and wherein:

function of change in price for change in yield, duration, a precise first derivative deriving by exact differentiation [by mathematical calculus] of said non-summation form function discounting cash receipts, utilizing endogenous variables C, Y, T only:

Duration, modified annualized, semi-annual C:

$$K = \frac{-C}{Y^2}\left(1 - (1 + Y/2)^{-2T}\right) + \frac{C}{Y}(T + TY/2)^{-2T-1} - (T + TY/2)^{-2T-1}$$

where C=Coupon Y=YTM T=Maturity in Years $\delta Y = \Delta$Yield M $\delta P = \Delta$Price

Duration, modified annualized, wherein n annual C payments:

$$K \text{ generalized} = \frac{-C}{Y^2}\left(1 - (1 + Y/n)^{-nT}\right) + \frac{C}{Y}(T + TY/n)^{-nT-1} - (T + TY/n)^{-nT-1}$$

where n = # cash receipts per annum, wherein semi-annual form is determined as:

$$K = \frac{-C}{Y^2} + \frac{C}{Y^2}(1 + Y/2)^{-2T} - (1 - C/Y)(T + TY/2)^{-2T-1}$$

wherein as coded computational processing algorithms:

K semi-annual = DPDY = ((-C/(Y^2))*(1−((1+(.5*Y))^(-2*T))))
+((C/Y)*((T+(.5*Y*T))^((-2*T) −1)))
−((T+(.5*Y*T))^((-2*T) −1))

where C and Y are decimal values, T=Maturity in years

K generalized =BONK= ((-C/(Y^2))*(1−((1+(Y/N))^(-N*T))))
+(((C/Y) −1)*T*((1+(Y/N))^((-N*T)−1)))

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

generalized, alternate formulation
K generalized =BINK= (-C/(Y^2))+((C/(Y^2))*((1+(Y/N))^(-N*T)))
alternate form −((1−(C/Y))*((T+((T*Y)/N))^((-N*T) −1)));

function of change in the change in yield, convexity, a precise second derivative deriving by exact differentiation [by mathematical calculus] of said non-summation form function discounting cash receipts, utilizing endogenous variables C, Y, T only:

Convexity

$$V = \frac{2C}{Y^3} - \frac{\frac{2C}{Y^3}}{(1+Y/2)^{2T}} - \frac{\frac{CT}{Y^2}}{(1+Y/2)^{2T+1}} - \frac{\frac{C}{Y^2}}{(T+TY/2)^{2T+1}} + \frac{(1+C/Y)(T^2+T/2)}{(T+TY/2)^{2T+2}}$$

wherein V can be calculated where Y = YTM, Yield M, or, Yield M − YTM basis,

wherein as coded computational processing algorithms:

generalized
V =BONV= (((2*C)/(Y^3))*(1−(1+(Y/N))^(-N*T)))
−((C/Y^2)*(2*T)*((1+(Y/N))^((-N*T) −1)))
−(((C/Y) −1)*(((N*T)+1)*(T/N))*((1+(Y/N))^((-N*T) −2)))
where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

spread-based, semi-annual
V =VEXA= (((2*C)/(Y^3)) −(((2*C)/(Y^3))*((1+(Y/2))^(-2*T)))
−((C*T)/(Y^2))*((1+(Y/2))^((-2*T) −1))
−((C/(Y^2))*((T+(T*(Y/2)))^((-2*T) −1)))
+((1+(C/Y))*((T^2)+(T/2))*((T+(T*(Y/2)))^((-2*T) −2))))/10000
where Y=spread=YieldM−YTM, expressed in decimal, wherein if Y=0.14%=0.14
where Y=Yield M, expressed in decimal, wherein if Y= Yield M= 6.06%= 0.0606

spread-based, generalized

V =VEX= (((2*C)/(Y^3)) −(((2*C)/(Y^3))*((1+(Y/N))^(-N*T)))
−((C*T)/(Y^2))*((1+(Y/N))^((-N*T) −1))
−((C/(Y^2))*((T+(T*(Y/N)))^((-N*T) −1)))
+((1+(C/Y))*((T^2)+(T/N))*((T+(T*(Y/N)))^((-N*T) −2))))/10000

where Y = Yield M, expressed in decimal, wherein if Y = Yield M = 6.06% = 0.0606.

71. (currently amended) A process for estimating change in price of a security, or of an aggregated portfolio, respective change in yield, instantaneous or as occurring over a discrete time, comprising:

utilizing data values of said security's Yield M or Md, Duration K, and Convexity V, wherein said Yield M or Md, Duration K and Convexity V computing by operating mathematical processing codes in computer systems and computational devices, wherein:

$$\text{Yield M} = \frac{\sum \text{(Maturity} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity), for all issues}}{\sum \text{(Maturity} \times \text{Portfolio Coefficient), for all issues}}$$

wherein as coded computational processing algorithm:

Yield M =YM = (sum{(Maturity*Portfolio Coefficient*YTM)$_1$, (M*PC*YTM)$_2$,...})/
(sum{(Maturity*Portfolio Coefficient)$_1$, (M*PC)$_2$,...});

$$\text{Yield Md} = \frac{\sum \text{(Duration} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity), for all issues}}{\sum \text{(Duration} \times \text{Portfolio Coefficient), for all issues}}$$

wherein as coded computational processing algorithm:

Yield Md =YMD = (sum{(Duration*PC*YTM)$_1$, (D*PC*YTM)$_2$,...})/
(sum{(Duration*Portfolio Coefficient)$_1$, (D*PC)$_2$,...})

where Issue = Security; All Issues = Securities comprising a basket of securities
Yield M = Governing Yield = Y
Maturity = Time = Maturity in Years, Expected Life, Term of Policy
Portfolio Coefficient = Present Value, per issue/Present Value, ∑ issues
Present Value = Cost to Presently Purchase
YTM = Yield-To-Maturity, a means providing yield respective time, determining YTM by summation or non-summation form,
for Single Issue: Portfolio Coefficient is one, Yield M = YTM
for Portfolio: the Yield M functions create a single Yield M value of all issues;

Duration, modified annualized, semi-annual C:

$$K \quad = \frac{-C}{Y^2}\left(1 - (1 + Y/2)^{-2T}\right) + \frac{C}{Y}(T + TY/2)^{-2T-1} - (T + TY/2)^{-2T-1}$$

where C=Coupon Y=YTM T=Maturity in Years $\delta Y = \Delta$Yield M $\delta P = \Delta$Price

Duration, modified annualized, wherein n annual C payments:

$$K \text{ generalized} = \frac{-C}{Y^2}\left(1 - (1 + Y/n)^{-nT}\right) + \frac{C}{Y}(T + TY/n)^{-nT-1} - (T + TY/n)^{-nT-1}$$

wherein n = # cash receipts per annum, whereas semi-annual form [can also be written] <u>is written as</u>:

$$K \quad = \quad \frac{-C}{Y^2} + \frac{C}{Y^2}(1 + Y/2)^{-2T} - (1 - C/Y)(T + TY/2)^{-2T-1}$$

wherein as coded computational processing algorithms:

```
K semi-annual= DPDY =   ((-C/(Y^2))*(1-((1+(.5*Y))^(-2*T))))
                        +((C/Y)*((T+(.5*Y*T))^((-2*T) -1)))
                        -((T+(.5*Y*T))^((-2*T) -1))
```

where C and Y are decimal values, T=Maturity in years

```
K generalized =BONK=    ((-C/(Y^2))*(1-((1+(Y/N))^(-N*T))))
                        +(((C/Y) -1)*T*((1+(Y/N))^((-N*T)-1)))
```

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

generalized, alternate formulation

```
K generalized =BINK=    (-C/(Y^2))+((C/(Y^2))*((1+(Y/N))^(-N*T)))
alternate form          -((1-(C/Y))*((T+((T*Y)/N))^((-N*T) -1)));
```

Convexity

$$V \quad = \quad \frac{2C}{Y^3} - \frac{\frac{2C}{Y^3}}{(1+Y/2)^{2T}} - \frac{\frac{CT}{Y^2}}{(1+Y/2)^{2T+1}} - \frac{\frac{C}{Y^2}}{(T+TY/2)^{2T+1}} + \frac{(1+C/Y)(T^2+T/2)}{(T+TY/2)^{2T+2}}$$

wherein V can be calculated where Y = YTM, Yield M, or, Yield M – YTM basis, wherein as coded computational processing algorithms:

generalized

```
V   =BONV=   (((2*C)/(Y^3))*(1-(1+(Y/N))^(-N*T)))
             -((C/Y^2)*(2*T)*((1+(Y/N))^((-N*T) -1)))
             -(((C/Y) -1)*(((N*T)+1)*(T/N))*((1+(Y/N))^((-N*T) -2)))
```

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

spread-based, semi-annual

V =VEXA= (((2*C)/(Y^3)) –(((2*C)/(Y^3))*((1+(Y/2))^(-2*T)))
–((C*T)/(Y^2))*((1+(Y/2))^((-2*T) –1))
–((C/(Y^2))*((T+(T*(Y/2)))^((-2*T) –1)))
+((1+(C/Y))*((T^2)+(T/2))*((T+(T*(Y/2)))^((-2*T) –2))))/10000

where Y=spread=YieldM–YTM, expressed in decimal, wherein if Y=0.14%=0.14
where Y=Yield M, expressed in decimal, wherein if Y= Yield M= 6.06%= 0.0606

spread-based, generalized

V =VEX= (((2*C)/(Y^3)) –(((2*C)/(Y^3))*((1+(Y/N))^(-N*T)))
–((C*T)/(Y^2))*((1+(Y/N))^((-N*T) –1))
–((C/(Y^2))*((T+(T*(Y/N)))^((-N*T) –1)))
+((1+(C/Y))*((T^2)+(T/N))*((T+(T*(Y/N)))^((-N*T) –2))))/10000

where Y = Yield M, expressed in decimal, wherein if Y = Yield M = 6.06% = 0.0606;

identifying change in said Yield M data value at instant or as occurring over time, wherein measuring, entering or updating input values of variables determining Yield M value;

calculating change in price of the security given said change in said Yield M by implementing factorization, wherein utilizing K for duration, Δ Price, due to Duration (K):

A: Δ Price, due to Duration (K) = $K \times \Delta\ Y$;

calculating change in price of the security given said change in said Yield M by implementing factorization, wherein utilizing V for convexity, Δ Price, due to Convexity (V):

B: Δ Price, due to Convexity (V) = $\frac{1}{2} \times V \times (\Delta\ Y)^2$;

summing values determined by A+B, wherein comprising Δ Price, due to K and V:

$$\Delta \text{ Price} = (K \times \Delta Y) + (\tfrac{1}{2} \times V \times (\Delta Y)^2);$$

determining arbitrage spread of computed Δ Price versus actual notched Δ Price, wherein calculating a differential between said computed and said actual notched Δ Price;

sending said determined and calculated Yield M or MD, K and V values, and said computed and actual Δ Price, and arbitrage spread to output, monitor, storage or further process.

72. (original) The process of claim 71, which further comprises applying a universal factorization:

$$\Delta \text{ Price} = (-\ |\text{Duration}|\ \times \delta Y) + (\tfrac{1}{2} \times \text{Convexity} \times (\delta Y)^2);$$

wherein $\delta Y \cong \Delta Y$, and wherein $\Delta Y = \Delta$Yield M or ΔYield-to-Maturity,

wherein ΔYield-to-Maturity = YTM as non-summation, or as summation, form:

function of yield-to-maturity, a non-summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{Y}\left(1 - (1 + Y/2)^{-2T}\right) + (1 + Y/2)^{-2T}$$

where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded computational processing algorithm:

semi-annual   P = PR = ((C/Y)*(1–(1+(Y/2))^(-2*T))+(1+(Y/2))^(-2*T)
where C, Y and P are decimal values, T=Maturity in years,

generalized   P = PRBOND= ((C/Y)*(1–(1+(Y/N))^(-N*T))+(1+(Y/N))^(-N*T)
where N=n= cash receipts per annum, wherein semi-annual=2;

function of yield-to-maturity, a summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{2} \sum_{T=1}^{2T} (1 + Y/2)^{-T} + (1 + Y/2)^{-2T}$$

where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded computational processing algorithm:

Price= P = (C/2)*(sum{(((1+(Y/2))^(-T))+((1+(Y/2)^(-2*T)))$_1$,
(((1 + (Y/2)^(-T))+((1+(Y/2)^(-2*T))) $_2$,...})
where semi-annual coupon payments (2 per annum);

Price= P = (C/N)*(sum{(((1+(Y/N))^(-T))+((1+(Y/N)^(-N*T)))$_1$,
(((1 + (Y/N)^(-T))+((1+(Y/N)^(-N*T))) $_2$,...})
where N-annual coupon payments (N per annum);

and wherein Duration = K, or as = a first order Taylor series approximation of first derivative of summation form YTM, wherein said first order approximation comprising:

$$\text{(Duration) Durmodan} = \frac{\dfrac{C}{Y^2}\left[1 - \dfrac{1}{(1+Y)^{2T}}\right] + \dfrac{2T(100 - C/Y)}{(1+Y)^{2T+1}}}{2P}$$

where D = $\Delta P/\Delta$YTM
Y = YTM
T = Mat. in Years
C = Coupon
P=Price (par=100),

wherein as coded computational processing algorithms:

semi-annual Durmodan=DURMOD=((((C/2)/((Y/2)^2))*(1−(1/((1+(Y/2))^(2*T)))) +((2*T)*(100−((C/2)/(Y/2))))/((1+(Y/2))^((2*T)+1))))/(2*P)
where P = Price (of 100)

generalized Durmodan=DURMD= ((((C/N)/((Y/N)^2))*(1−(1/((1+(Y/N))^(N*T)))) +(((N*T)*(100−((C/N)/(Y/N))))/((1+(Y/N))^((N*T)+1))))/(2*P)

where N=n= # C periods per annum, where semi-annual=2; T=Maturity in years;

and wherein Convexity = V, or as = a second order Taylor series term, comprising a second derivative approximation of summation form YTM, wherein said second order term:

$$\text{(Convexity) Convex} = \frac{\dfrac{2C}{Y^3}\left[1 - \dfrac{1}{(1+Y)^{2T}}\right] + \dfrac{2C(2T)}{Y^2(1+Y)^{2T+2}} + \dfrac{2T(2T+1)(100 - C/Y)}{(1+Y)^{2T+2}}}{4P}$$

wherein as coded algorithm:

semi-annual Convex = CON = (((C/((Y/2)^3))*(1−(1/((1+(Y/2))^(2*T))))) −((C*(2*T))/(((Y/2)^2)*((1+(Y/2))^((2*T)+1)))) +(((2*T)*((2*T)+1)*(100-(C/Y)))/((1+(Y/2))^((2*T)+2))))/(4*P)

generalized Convex = CONDP = (((C/((Y/N)^3))*(1−(1/((1+(Y/N))^(N*T))))) −((C*(N*T))/(((Y/N)^2)*((1+(Y/N))^((N*T)+1)))) +(((N*T)*((N*T)+1)*(100-(C/Y)))/((1+(Y/N))^((N*T)+2))))/(4*P)

where N=n= # C periods per annum, where semi-annual=2; T=Maturity in years.

73. (original) The process of claim 71, which further comprises adding a derivative respecting time, and further comprises adding any accrued interest, wherein using dirty (full) price in A and B:

$$\Delta P = A + B + C + D$$

wherein,

ΔP = change in bid price, for given changes in yield and time,

A = -abs(Duration) × Price(dirty) × ΔY

B = ½ × Convexity × Price(dirty) × $(\Delta Y)^2$

$C = \text{Theta} \times \text{Price(dirty)} \times \Delta t$

$D = -(\Delta \text{ Accrued Interest, for given } \Delta t)$,

and wherein,

Y (YTM), by Formula Yield M, or Yield Md, or
YTM by non-summation or by summation form function,
Duration by Formula K, or by first term Taylor series approximation,
Convexity by Formula V, or by second term Taylor series approximation,
Theta (θ), such a theta: $\theta = 2 \ln(1+r/2)$, wherein r = ytm or Yield M,
Price (dirty) equals bid price plus accumulated interest,
Δt is elapsed time between two points whereby estimations are made,
ΔP rounded to nearest pricing gradient, ΔP occurring Δt, determining arbitrage spread of computed Δ Price versus actual notched Δ Price.

74. (original) A process for valuing a financial portfolio, containing more than one divisible issue, wherein an issue is a security and a portfolio comprises all issues comprising said portfolio, by singular portfolio (P) data values of endogenous variables C^P, Y^P, T^P, comprising:

identifying data values for each issue's endogenous variables of C, Y, T, wherein:

C = Cash Receipts, periodic coupon, dividend or premium payments
Y = Yield, a single term relating security's return, relative to P, C, T
T = Time = Maturity in Years, Expected Life, Term of Policy;

generating portfolio coefficients for each issue in portfolio, by:

Portfolio Coefficient, per each Issue = Present Value^I/Present Value^P;

Present Value^I = (AI + (Bid Price$\times$Face Value)), per Issue (I);

Present Value^P = Σ (AI+(Bid Price$\times$Face Value), for all Issues;

generating aggregate portfolio (P) data relating portfolio's value, by:

Present Value^P = Σ (AI + (Bid Price $\times$ Face Value)), for all Issues;

Accrued Interest^P = Σ Accrued Interest, AI, for all Issues;

Face Value^P = Σ Face Value, for all Issues;

$$\text{Implied Price}^P = (\text{Present Value}^P - AI^P) / \sum \text{Face Value for all Issues};$$

generating aggregate portfolio (P) data relating portfolio's variables:

$$C^P = \text{Cash Flow}^P = \sum C \times \text{Portfolio Coefficient, for all Issues};$$

$$T^P = \text{Time}^P = \sum \text{Maturity} \times \text{Portfolio Coefficient, for all Issues};$$

$$Y^P = \text{Yield}^P = \sum \text{Yield} \times \text{Portfolio Coefficient, for all Issues};$$

if for a portfolio of U. S. Treasury issues, C^P, Y^P, T^P comprising:

$$C^P = \text{Coupon}^P = \sum \text{Coupon} \times \text{Portfolio Coefficient, for all Issues};$$

$$T^P = \text{Maturity}^P = \sum \text{Maturity} \times \text{Portfolio Coefficient, for all Issues};$$

$$Y^P = \text{Yield}^P = \sum \text{Yield} \times \text{Portfolio Coefficient, for all Issues};$$

computing portfolio's duration and convexity:

$$\text{Duration}^P = \sum \text{Duration} \times \text{Portfolio Coefficient, for all Issues};$$

$$\text{Convexity}^P = \sum \text{Convexity} \times \text{Portfolio Coefficient, for all Issues}.$$

or utilizing portfolio values, C^P, Y^P, T^P, computing Duration and Convexity.

75. (original) The process of claim 74, which further comprises establishing a governing yield value for said portfolio, wherein said value also representing a yield value relative a spot or forward curve, said value calculating by Formula, Yield M, or Formula, Yield Md,:

$$\text{Yield M} = \frac{\sum (\text{Maturity} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{ for all issues}}{\sum (\text{Maturity} \times \text{Portfolio Coefficient}), \text{ for all issues}}$$

wherein as coded algorithm:

$$\text{Yield M} = \text{YM} = (\text{sum}\{(\text{Maturity*Portfolio Coefficient*YTM})_1, (\text{M*PC*YTM})_2, \ldots\}) / (\text{sum}\{(\text{Maturity*Portfolio Coefficient})_1, (\text{M*PC})_2, \ldots\});$$

$$\text{Yield Md} = \frac{\sum (\text{Duration} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{ for all issues}}{\sum (\text{Duration} \times \text{Portfolio Coefficient}), \text{ for all issues}}$$

wherein as coded algorithm:

Yield Md =YMD = (sum{(Duration*PC*YTM)$_1$, (D*PC*YTM)$_2$,...})/
(sum{(Duration*Portfolio Coefficient)$_1$, (D*PC)$_2$,...})

where Issue = Security; All Issues = Securities comprising a portfolio of securities
Yield M = Governing Yield = Y
Maturity = Time = Maturity in Years, Expected Life, Term of Policy
Portfolio Coefficient = Present Value, per issue/Present Value, $\sum$ issues
Present Value = Cost to Presently Purchase
YTM = Yield-To-Maturity, a means providing yield respective time.

76. (original) An apparatus, generating and computing financial data, an analytic valuation engine, comprising:

means to input values from a data-feed, stored memory or by hand-entry, for a security, or for securities in a portfolio, with respect to endogenous variables C, Y and T, wherein C comprising interest coupons, dividend payments or insurance premiums, and wherein Y comprising a single term relating said security's return respective price, C and T, and wherein T comprising maturity in years, expected life, or term of a policy;

means for calculating governing yield, Yield M, for security or for portfolio, wherein applying coded calculation algorithm calculating Yield M, said Yield M comprising:

function of governing yield, a singular universal form for securities

$$\text{Yield M} = \frac{\sum(\text{Maturity} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{ for all issues}}{\sum(\text{Maturity} \times \text{Portfolio Coefficient}), \text{ for all issues}}$$

where Issue = Security; All Issues = Securities comprising a portfolio of securities

wherein Yield M as coded algorithm:

Yield M =YM = (sum{(Maturity*Portfolio Coefficient*YTM)$_1$, (M*PC*YTM)$_2$,...})/

(sum{(Maturity*Portfolio Coefficient)$_1$, (M*PC)$_2$,...});

means for sending said calculated value to a user monitor, storage or to a display screen;

means for computing said security's market yield values using coded algorithms:

function of yield-to-maturity, a summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{2} \sum_{T=1}^{2T} (1 + Y/2)^{-T} + (1 + Y/2)^{-2T}$$

where C = Coupon Y = YTM T = Maturity (in years),

wherein as coded computational processing algorithm:

Price= P = (C/2)*(sum{(((1+(Y/2))^(-T))+((1+(Y/2)^(-2*T)))$_1$,
(((1 + (Y/2)^(-T))+((1+(Y/2)^(-2*T))) $_2$,...})
where semi-annual coupon payments (2 per annum);

Price= P = (C/N)*(sum{(((1+(Y/N))^(-T))+((1+(Y/N)^(-N*T)))$_1$,
(((1 + (Y/N)^(-T))+((1+(Y/N)^(-N*T))) $_2$,...})
where N-annual coupon payments (N per annum); or

function of yield-to-maturity, a non-summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{Y} (1 - (1 + Y/2)^{-2T}) + (1 + Y/2)^{-2T}$$

where C = Coupon Y = YTM T = Maturity (in years),

wherein as coded computational processing algorithm:

semi-annual P = PR = ((C/Y)*(1–(1+(Y/2))^(-2*T))+(1+(Y/2))^(-2*T)
where C, Y and P are decimal values, T=Maturity in years,

generalized P = PRBOND= ((C/Y)*(1–(1+(Y/N))^(-N*T))+(1+(Y/N))^(-N*T)
where N=n= cash receipts per annum, semi-annual=2;

means for sending governing yield value and market yield values to processing, wherein computing duration, convexity and theta of said security, wherein comprising utilizing applicable coded computational algorithms:

function of duration, modified annualized, semi-annual C:

$$K = \frac{-C}{Y^2}(1 - (1 + Y/2)^{-2T}) + \frac{C}{Y} (T + TY/2)^{-2T-1} - (T + TY/2)^{-2T-1}$$

where C=Coupon Y=YTM T=Maturity in Years δY=ΔYield M δP=ΔPrice

function of duration, modified annualized, wherein n annual C payments:

$$K\ \text{generalized} = \frac{-C}{Y^2}\left(1 - (1 + Y/n)^{-nT}\right) + \frac{C}{Y}(T + TY/n)^{-nT-1} - (T + TY/n)^{-nT-1}$$

wherein n = # cash receipts per annum, whereas semi-annual form can also be written:

$$K = \frac{-C}{Y^2} + \frac{C}{Y^2}(1 + Y/2)^{-2T} - (1 - C/Y)(T + TY/2)^{-2T-1}$$

wherein as coded computational processing algorithms:

K semi-annual = DPDY = ((-C/(Y^2))*(1–((1+(.5*Y))^(-2*T))))
+((C/Y)*((T+(.5*Y*T))^((-2*T) –1)))
–((T+(.5*Y*T))^((-2*T) –1))

where C and Y are decimal values, T=Maturity in years

K generalized =BONK= ((-C/(Y^2))*(1–((1+(Y/N))^(-N*T))))
+(((C/Y) –1)*T*((1+(Y/N))^((-N*T)–1)))

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

generalized, alternate formulation:

K generalized =BINK= (-C/(Y^2))+((C/(Y^2))*((1+(Y/N))^(-N*T)))
alternate form –((1–(C/Y))*((T+((T*Y)/N))^((-N*T) –1)));

function of convexity, semi-annual C:

Convexity

$$V = \frac{2C}{Y^3} - \frac{\frac{2C}{Y^3}}{(1+Y/2)^{2T}} - \frac{\frac{CT}{Y^2}}{(1+Y/2)^{2T+1}} - \frac{\frac{C}{Y^2}}{(T+TY/2)^{2T+1}} + \frac{(1+C/Y)(T^2+T/2)}{(T+TY/2)^{2T+2}}$$

wherein V can be calculated where Y = YTM, Yield M, or, Yield M – YTM basis,

wherein as coded computational processing algorithms:

generalized

V =BONV= (((2*C)/(Y^3))*(1–(1+(Y/N))^(-N*T)))
–((C/Y^2)*(2*T)*((1+(Y/N))^((-N*T) –1)))
–(((C/Y) –1)*(((N*T)+1)*(T/N))*((1+(Y/N))^((-N*T) –2)))

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

spread-based, semi-annual

V =VEXA= (((2*C)/(Y^3)) –(((2*C)/(Y^3))*((1+(Y/2))^(-2*T)))
–((C*T)/(Y^2))*((1+(Y/2))^((-2*T) –1))
–((C/(Y^2))*((T+(T*(Y/2)))^((-2*T) –1)))
+((1+(C/Y))*((T^2)+(T/2))*((T+(T*(Y/2)))^((-2*T) –2))))/10000

where Y=spread=YieldM–YTM, expressed in decimal, wherein if Y=0.14%=0.14
where Y=Yield M, expressed in decimal, wherein if Y= Yield M= 6.06%= 0.0606

spread-based, generalized

V =VEX= (((2*C)/(Y^3)) −(((2*C)/(Y^3))*((1+(Y/N))^(-N*T)))
−((C*T)/(Y^2))*((1+(Y/N))^((-N*T) −1))
−((C/(Y^2))*((T+(T*(Y/N)))^((-N*T) −1)))
+((1+(C/Y))*((T^2)+(T/N))*((T+(T*(Y/N)))^((-N*T) −2))))/10000

where Y = Yield M, expressed in decimal, wherein if Y = Yield M = 6.06% = 0.0606;

wherein comprising, if using market yield summation form, utilizing coded algorithms:

function of duration, modified annualized, semi-annual C:

$$\text{(Duration) Durmodan} = \frac{\frac{C}{Y^2}\left[1 - \frac{1}{(1+Y)^{2T}}\right] + \frac{2T(100 - C/Y)}{(1+Y)^{2T+1}}}{2P}$$

where D = ΔP/ΔYTM
Y = YTM
T = Mat. in Years
C = Coupon
P=Price (par=100),

wherein as coded computational processing algorithms:

semi-annual Durmodan=DURMOD=((((C/2)/((Y/2)^2))*(1−(1/((1+(Y/2))^(2*T)))))
+((2*T)*(100−((C/2)/(Y/2))))/((1+(Y/2))^((2*T)+1))))/(2*P)
where P = Price (of 100)

generalized Durmodan=DURMD= ((((C/N)/((Y/N)^2))*(1−(1/((1+(Y/N))^(N*T))))
+(((N*T)*(100−((C/N)/(Y/N))))/((1+(Y/N))^((N*T)+1))))/(2*P)

where N=n= # C periods per annum; semi-annual=2; T=Maturity in years;

function of convexity, semi-annual C:

$$\text{(Convexity) Convex} = \frac{\frac{2C}{Y^3}\left[1 - \frac{1}{(1+Y)^{2T}}\right] + \frac{2C(2T)}{Y^2(1+Y)^{2T+2}} + \frac{2T(2T+1)(100 - C/Y)}{(1+Y)^{2T+2}}}{4P}$$

wherein as coded computational processing algorithms:

semi-annual Convex = CON = (((C/((Y/2)^3))*(1−(1/((1+(Y/2))^(2*T)))))
−((C*(2*T))/(((Y/2)^2)*((1+(Y/2))^((2*T)+1))))
+(((2*T)*((2*T)+1)*(100-(C/Y)))/((1+(Y/2))^((2*T)+2))))/(4*P)

generalized Convex = CONDP = (((C/((Y/N)^3))*(1−(1/((1+(Y/N))^(N*T)))))
−((C*(N*T))/(((Y/N)^2)*((1+(Y/N))^((N*T)+1))))
+(((N*T)*((N*T)+1)*(100-(C/Y)))/((1+(Y/N))^((N*T)+2))))/(4*P)

where N=n= # C periods per annum; semi-annual=2; T=Maturity in years;

function of theta, utilizing coded algorithm applicable if YTM or if Yield M:

generalized Theta (θ), wherein theta: $\theta = 2 \ln(1+r/2)$, wherein r = YTM or Yield M;

means for sending said yield, and derivatives, data set to data storage or display output;

means for computing factorization for change in price over time, comprising algorithm:

$$\Delta P = A + B + C + D$$

wherein,

ΔP = change in bid price, for given changes in yield and time,

$A = -\text{abs}(\text{Duration}) \times \text{Price(dirty)} \times \Delta Y$

$B = \frac{1}{2} \times \text{Convexity} \times \text{Price(dirty)} \times (\Delta Y)^2$

$C = \text{Theta} \times \text{Price(dirty)} \times \Delta t$

$D = -(\Delta$ Accrued Interest, for given $\Delta t)$,

and wherein,

Y (YTM), by Formula Yield M, or Yield Md, or

YTM by non-summation or by summation form function,

Duration by Formula K, or by first term Taylor series approximation,

Convexity by Formula V, or by second term Taylor series approximation,

Theta (θ), wherein theta: $\theta = 2 \ln(1+r/2)$, wherein r = YTM,

Price (dirty) equals bid price plus accumulated interest,

Δt is elapsed time between two points whereby estimations are made,

ΔP rounded to nearest pricing gradient, ΔP occurring Δt;

means for sending said computed factorization values to data storage or display output;

means for sending said governing yield values to data storage or display output;

means for sending said duration and convexity values to data storage or display output.